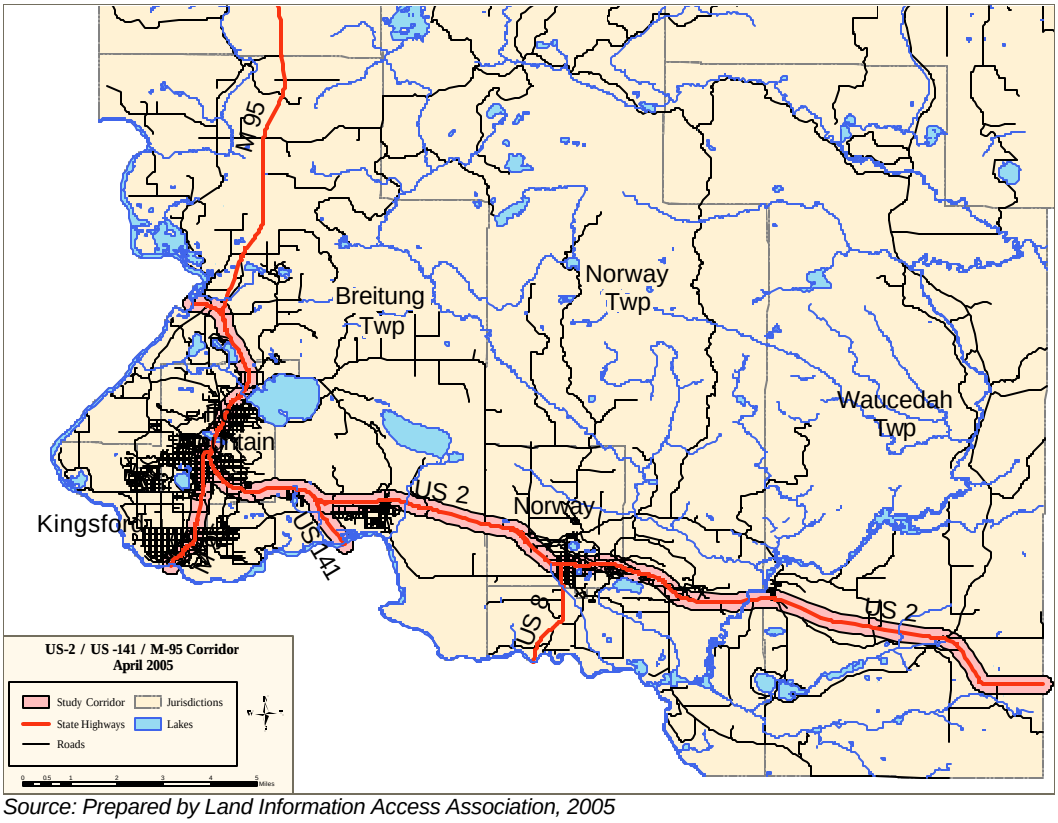
Chapter Three
ROAD DESCRIPTION, PROBLEM AND OPPORTUNITY ANALYSIS

INTRODUCTION

This Chapter gives an overview of the physical, as well as traffic and safety issues associated with the US-2/US-141/M-95 highway corridor in Dickinson County. The study area for this Plan is described as US-2 from the west Menominee County boundary to the west Dickinson County boundary at the Wisconsin state-line; US-141 from the Wisconsin border south of Quinnesec to the junction with US-2; and M-95 from the Wisconsin border north through Kingsford and Iron Mountain to the intersection of US-2/US-141. The corridor, which is approximately 28 miles in length affects the cities of Iron Mountain, Kingsford, and Norway, and the Townships of Breitung, Norway, and Waucedah.

US-2 and US-141 are classified as U.S. Routes while M-95 is classified as a State Route. All three serve as primary highways for local citizens in the region, but US-2 also serves as a thoroughfare for those traveling across the Upper Peninsula. See Figure 3-1.

Figure 3-1
Location Map



Source: Prepared by Land Information Access Association, 2005

CORRIDOR ROADWAY DESCRIPTION

Roadway Geometry and Speed

From the western edge of Dickinson County and Breitung Township, heading southeast on US-2/US-141 towards the City of Iron Mountain, the speed limit changes several times. Entering into Michigan from Wisconsin, US-2/US-141 is a two lane rural highway with a 55 MPH speed limit until just before its intersection with M-95 where it divides into a four-lane divided highway. After US-2/US-141 merge with M-95, the four-lane divided highway continues a short distance, then becomes a four-lane highway for a mile before widening to five-lanes near the Iron Mountain City limits. At the city limits, the speed limit decreases to 45 MPH and at Grand Boulevard the speed limit decreases to 35 MPH. The speed limit remains 35 MPH until crossing over Chapin Pit where it then decreases to 25 MPH. The five-lane highway ends at Ludington Street where it then becomes four-lane. At the D Street intersection, the speed limit returns to 35 MPH. The four lane highway continues from the intersection of D Street to the intersection of Michigan Avenue, however this segment is under re-construction and will become a five-lane highway by fall of 2005. From the Michigan Avenue intersection to the US-141 intersection, the highway is five-lanes with a speed limit of 45 MPH until passing Iron Mountain Plaza and Dickinson County Hospital where the speed limit increases to 55 MPH.

Just before intersecting US-141 the five-lane highway goes to a four-lane divided highway at the intersection and then continues at the 55 MPH speed limit as a five-lane road until reaching the City of Norway where the highway becomes a four-lane highway and the speed limit decreases to 40 MPH, 600' east of Belgium Town Road intersection. The speed limit decreases again to 30 MPH 600' east of intersection at W 9th Street, just before the bend in the road. The speed limit remains 30 MPH through downtown Norway then increases to 40 MPH at the intersection of Walnut Street and goes back up to 55 MPH at E 7th Street intersection, just after the railroad crossing.

As soon as one leaves the City of Norway, the four-lane highway merges into a two-lane rural highway and returns to a 55 MPH speed limit. This speed limit remains until passing Ball Road and traveling 1000'. Here the speed limit reduces to 50 MPH until one is approximately 1000' past County Road 573 where it increases back to 55 MPH and continues that way to the Dickinson County line.

In the City of Iron Mountain, where M-95 splits off of US-2/US-141 at the East Ludington Street intersection, M-95 (also called Carpenter Avenue) is a four-lane highway with a 25 MPH speed limit until reaching the intersection of Hamilton Street where the four-lane highway becomes a five-lane highway and the speed limit increases to 35 MPH. Continuing traveling 35 MPH heading south on M-95, the five-lane highway continues to Breen Avenue and then narrows to a two-lane highway. From here the speed limit goes up to 45 MPH until just before reaching the Wisconsin border where it slows down to 35 MPH.

Where US-141 and US-2 split, US-141 is a two-lane highway heading southeast to the Wisconsin border at a speed limit of 55 MPH.

Traffic and Safety Analysis

Volumes

According to 24 Hour AADT (average annual/daily traffic) volumes from 1994 to 2003 provided by the Michigan Department of Transportation and analyzed by Traffic Engineering Associates, Inc., US-2/US-141 in Iron Mountain has the highest traffic volume in Dickinson County, with close to 22,000 vehicles counted between H Street and Park Avenue. Looking at a greater area, starting from Margaret Street to the eastern city limits of Iron Mountain, this stretch of US-2/US-141 has the greatest concentration of vehicles per day on the corridor, with approximately 19,000 vehicles counted per day. If one keeps traveling east from the Iron Mountain city limits, the average declines steadily from 13,868 to 3,954 at the eastern edge of Dickinson County. Likewise north of Margaret Street the average number of vehicles per day steadily declines from 16,688 to 6,669 at the Wisconsin border. (See Table 3-1).

M-95 also experiences a large volume of daily traffic with the peak of 17,505 vehicles between Woodward Avenue and H Street. Moving south this peak declines to 5,548 vehicles per day, while north it declines to 5,035 vehicles where Ludington meets US-2. (See Table 3-1).

Table 3-1
MDOT 1994-2003 Average AADT Traffic Volume 24 Hour Count

US-2		
From	**To**	**1994-2003**
Wisconsin State Line	Pine Mountain Rd.	6,996
Pine Mountain Rd.	W Jct. M-95	7,036
W Jct. M-95	Moon Lake Rd.	11,800
Moon Lake Rd.	NCL Iron Mountain	12,081
NCL Iron Mountain	Lake Antoine Rd.	15,148
Lake Antoine Rd.	Margaret St.	16,688
Margaret St.	Third St.	19,875
Third St.	E Jct. M-95	19,668
E Jct. M-95	H St.	18,891
H St.	Park Ave.	21,915
Park Ave.	ECL Iron Mountain	19,972
ECL Iron Mountain	Dawns Lake Rd.	13,868
Dawns Lake Rd.	E Jct. US-141	13,669
E Jct. US-141	Lake Antoine/Quinnesec Rd.	10,536
Lake Antoine Rd.	WCL Norway @ Pine Creek Rd.	10,247
WCL Norway @ Pine Creek Rd.	9th St.	10,409
9th St.	Jct. US-8	10,269
Jct. US-8	7th Ave., East of the Railroad	10,010
7th Ave., East of the Railroad	Cedar St.	6,732
Cedar St.	Kellerman Rd.	6,272
Kellerman Rd.	Co. Rd. 569 to Foster City	4,548
Co. Rd. 569 to Foster City	WCL Powers	3,954

M-95		
From	**To**	**1994-2003**
Wisconsin State Line	SCL Kingsford @ Breen St.	5,548
SCL Kingsford @ Breen St.	Breitung Avenue	9,006
Breitung Avenue	East Blvd.	11,994
East Blvd.	Woodward Ave. (City Limits)	14,554
Woodward Ave. (City Limits)	H St.	17,505
H St.	Turn @ Carpenter & Ludington	10,179
Turn @ Carpenter & Ludington	N Jct. US-2	5,035
N Jct. US-2	S Jct. M-69 (Randville)	3,192
US-141		
From	**To**	**1994-2003**
Wisconsin State Line	Breitung Cut-off Road	6,624
Breitung Rd.	S Jct. US-2	6,122

Source: MDOT and Traffic Engineering Associates, Inc, 2004

CRASH ANALYSIS

Crash analysis of the years 1994 to 2003 yielded the following top fourteen crash locations on the corridor. The data was provided by MDOT, and sorted and analyzed by Traffic Engineering Associates, Inc. Table 3-2 illustrates the areas with the highest number of crashes during this nine year period. All crash locations are in the cities of Kingsford and Iron Mountain with the highest concentration along US-2/US-141 from A Street in Iron Mountain southeasterly to Jackson/Michigan Avenue. This is a 0.6 mile section of roadway with 244 crashes. These locations are generally mapped on Maps 4-1 through 4-6 in the next chapter.

Table 3-2
Serious Crash Locations Along US-2/US-141/M-95

Intersection	Number of Crashes
US-2/US-141 @ “H” Street	85
US-2/US-141 @ Jackson	54
US-2/US-141 @ Michigan Avenue	51
US-2/US-141 @ Margaret/Lake Antoine	49
US-2/US-141 @ “G” Street	42
M-95 @ Breitung	40
M-95 @ “C” Street	39
US-2/US-141 @ “F” Street	36
US-2/US-141 @ Third Street	36
US-2/US-141 @ M-95	32
US-2/US-141 @ “D” Street	26
M-95 @ East Boulevard	25
M-95 @ Hughitt	21
US-2/US-141 @ “A” Street	18

Source: MDOT, 1994-2003 & Traffic Engineering Associates, Inc., 2004

KEY ACCESS MANAGEMENT CONCEPTS

The following sections provide an introduction to some of the concepts that will be recommended for implementation on the US-2/US-141/M-95 corridor within Chapter Four. The concepts in this section outline methods to create a uniform treatment in access management to minimize potential conflicts between drivers.

Limit the Number of Driveways

A key to keeping crash levels low is restricting the number, location and spacing of driveways along the US-2/US-141/M-95 corridor. Numerous driveways along a corridor can cause driver confusion as drivers struggle to figure out exactly which driveway they need to turn into. The most basic fact associated with access related traffic crashes is that more driveways along a roadway result in more crashes. Driveways create conflicts between vehicles on the roadway and vehicles entering or leaving the roadway. Research shows that the more driveways per mile the higher the crash rate. See Table 3-3.

Table 3-3
Relationship of Driveway Density to Crash Rates

Driveways per Mile	Representative Crash Rate per Mile for a Multi-lane, Undivided Roadway	Increase in Crashes Associated with Higher Driveway Density
Under 20	3.4	-
20 to 40	5.9	+ 74%
40 to 60	7.4	+ 118%
Over 60	9.2	+ 171%

Source: MDOT Access Management Guidebook, 2001

Average lot widths on both sides of a road would be about 225 feet at 40 driveways per mile and about 170 feet at 60 driveways per mile. This is substantially more than is common in Iron Mountain, Kingsford, Norway, and Vulcan.

Whenever possible, communities and road authorities should limit the number of driveways per lot. This can be done through restrictions within the zoning ordinance and by using other techniques like shared access and connected parking lots. Recommendations will be made in Chapter Five.

Speed Progression

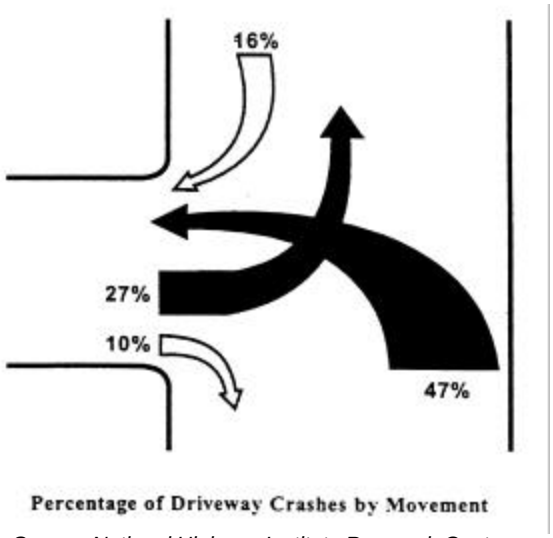
Poorly spaced signals hamper traffic progression. At least one-half mile between signals is typically desirable. Signals can provide the necessary break in traffic flow to permit vehicles to egress from properties lining the arterial. If signals are located too close, unnecessary traffic congestion can occur from through traffic which competes for road space with vehicles exiting driveways between signals. Irregularly spaced signals destroy the signal progression and therefore hamper traffic flow by increasing travel time and reducing capacity. After the relocation of one signal from downtown Iron Mountain to F Street in Summer of 2005, there will still be three signals one-block apart downtown. At an appropriate time, consideration should be given to removing at least one of those signals or possibly relocating one to Lake Antoine Road if warranted. Numerous

driveways can also limit speeds because ingress and egress vehicles cause traffic to slow down.

Left-turn Movements

Many of the access management techniques focus on reducing the number of driveways and eliminating left-turn movements into driveways. Medians and restricting turns can reduce the number of left-turn crashes to and from driveways. This is important because many studies show nearly 75% of all access related crashes are left-turns. See Figure 3-2. The left-turn movement into a driveway, without the benefit of a signal, accounts for 47% of the crashes associated with driveways. Twenty-seven percent of the crashes are turning left out of the driveway. Only 26% of driveway crashes are right-turns (with 16% in and 10% out).

Figure 3-2
Driveway Crashes by Movement



Source: National Highway Institute Research Center

Existing Land Use, Zoning and Future Land Use

The land uses developed along a corridor can greatly affect the capacity, safety and operation of the roadway. Commercial development along a corridor can often be characterized by a long row of separate narrow lots with individual driveways to each business, sometimes called “strip commercial development.” The large number of driveways which typically characterize this form of commercial development can result in increased congestion and traffic crashes because of the higher number of turning movements associated with commercial land uses compared to residential or other uses. There are also several entrances and exits to businesses along the US-2/US-141/M-95 corridor that are not well defined. An example is illustrated in Photo 3-1. These are commonly characterized as a large areas of pavement without curbing or pavement markings to direct traffic coming in and going out (see Photo 3-1).

Photo 3-1
Poorly Defined Ingress and Egress

Photo by Thyra Karlstrom, CUPPAD, 2004

By planning and zoning for mixed uses along arterials, by clustering multiple commercial uses around a single access road, and by limiting driveways on arterials, then commercial development can be accommodated without the attendant access management problems of strip commercial development. Mixed-use development might also link residential uses with commercial, so that people do not need to always use their car to go shopping. Mixed-use development could also provide office buildings with restaurants and shopping so workers could link potential lunchtime or after work trips. Linking day care establishments with office developments have been popular mixed-use developments which allows children to be near parents and reduces two daily trips from the roadway. Specific land use and zoning recommendations for the US-2/US-141/M-95 corridor will be introduced within Chapter Five.

Environmental Features and Conditions

Environmental features, such as the topography of an area, can have an impact on the safety of a road. Slopes along US-2/US-141/M-95 vary greatly and may be a factor in some of the crashes along the corridor particularly in inclement weather. Intersections with significant slopes are of particular concern because adequate sight distance is very important at an intersection. In several cases, a steep slope is combined with an angular intersection to make it even more challenging. See Photo 3-2 and Figure 3-6. Recommendations for individual intersections are presented in Chapter Four.

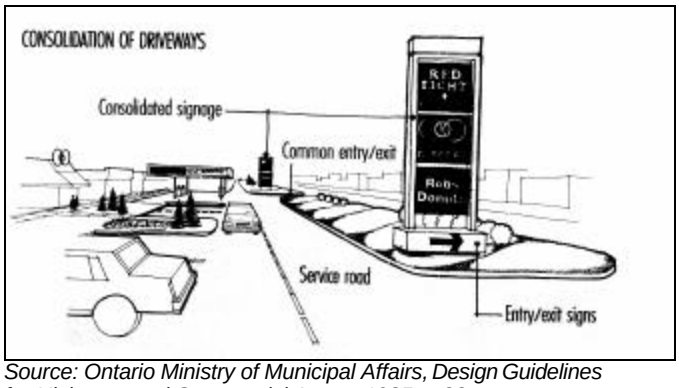
Photo 3-2
Swede Settlement Road Intersects US-2

Photo by Thyra Karlstrom, CUPPAD, 2004

Scenic and Aesthetic Considerations

Typically improving signage, views and landscaping is thought of as an aesthetic improvement. But these improvements can also help improve safety on the corridor as well. Creating uniform signage for traffic and pavement markings can help driver orientation to the road, and simple, uncluttered signs for private businesses can also help improve driver safety. This involves establishing maximum height, area and location standards for signs. Also important is limiting the number of signs, which can be distracting to the driver. The consolidation of sign marques can provide a neater appearance as well as a safer corridor. See Figure 3-3.

Figure 3-3
Consolidated Sign



Source: Ontario Ministry of Municipal Affairs, Design Guidelines for Highways and Commercial Areas , 1985, p.23.

Community "Welcome" signs can provide the driver information on where they are, but they need to be placed in an area where they can be easily viewed, and if at all possible, should be located at a focal point of entry to the community where there are no sight distance problems.

Landscaping and street trees are very important to "soften" the built environment and reduce the amount of pavement. However, these plantings need to take into account the road right-of-way as well as sight distances in and out of driveways. See Chapter Five for specific recommendations for aesthetics on the corridor. See Photo 3-3.

Photo 3-3
Landscaping Along Highway

Source: Thyra Karlstrom, CUPPAD, 2004

PRINCIPAL ROADWAY AND DRIVEWAY DESIGN STANDARDS

Capacity Improvements

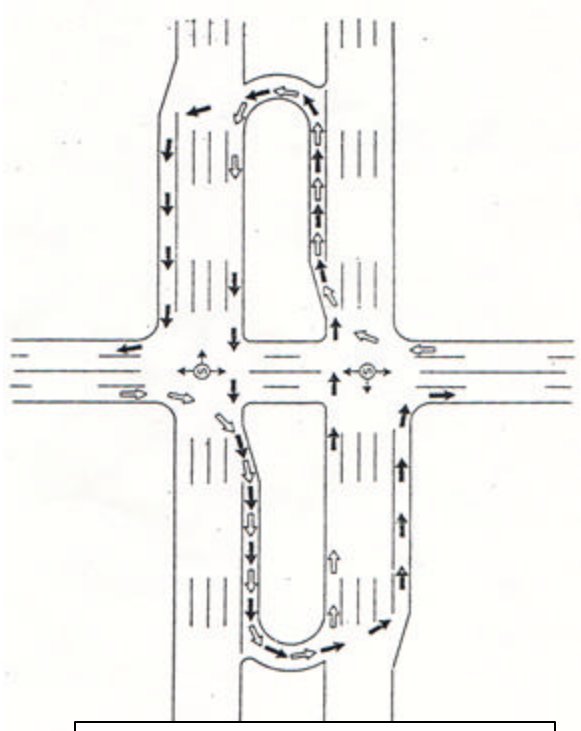
Additional Lanes

Adding lanes is a traditional solution implemented by many local governments and road agencies facing traffic congestion. However, particularly in urban areas where there is a lot of development adjacent to a highway, implementing access management strategies is often more cost effective than adding lanes due to the extremely high cost of purchasing additional right-of-way, moving utilities, and relocating parking, signs and any structures. Widening often also results in businesses and homes being very close to the new lanes, causing sight distance problems for motorists and noise problems for residents and shoppers.

Yet, where traffic volumes warrant widening a road and adding lanes, the investment will be maximized by also consolidating driveways, installing parallel access roads, and implementing other appropriate access management techniques as a part of the

widening project. The investment in added capacity should be protected by regulating the number and spacing of driveways that access the roadway.

Figure 3-4
Indirect U-turn



Source: Levinson, Herbert, et al. "*Indirect Left-turns-The Michigan Experience*" for the 4th Access Management Conference, 2000.

Boulevard Designs

Raised medians separate opposing traffic and reduce conflict points by eliminating left-turns into and out of driveways along an arterial. In fact, when properly designed, a roadway with limited median crossovers is the safest design with the maximum traffic carrying capacity. Medians are also effective at intersections to guide traffic while also separating it from opposing traffic. Separation allows for quicker turns and less traffic backups. US-2 from Norway to US-141 and from Iron Mountain to the border with Wisconsin are good candidates for boulevard designs.

Standard Median

The standard MDOT 50-60 foot median requires about 270 feet of total right-of-way. The standard median design also does not allow left-turns at intersecting roads. Figure 3-4 illustrates a standard Michigan median with an indirect left-turn. This is a safe design that has been widely copied around the world.

Narrow Width Medians

Narrow width medians, center islands that vary from 20 to 40 feet have been utilized in urban or suburban areas in Michigan where the right-of-way did not allow a standard median width. The narrow width median may require special turn-around lanes for trucks and buses because the narrow width geometry cannot adequately accommodate the large vehicles. See Photo 3-4 for an example. If boulevards were constructed on US-2, there are places where narrow width medians would be necessary because of inadequate space for a standard MDOT boulevard design.

Photo 3-4
Narrow Width Median on US-2/US-141/M-95

Source: Thyra Karlstrom, CUPPAD, 2004

Roundabouts

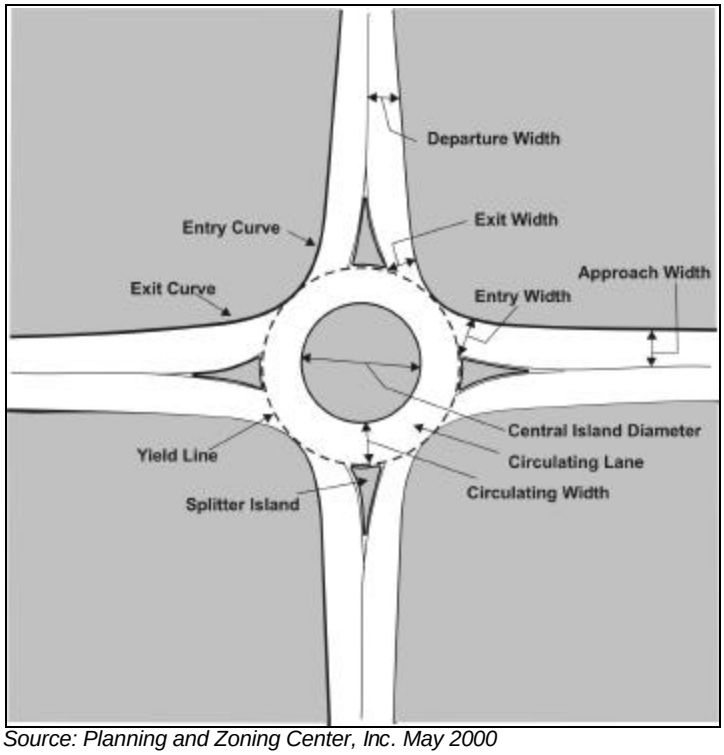
Roundabout design is beginning to be popular in America because of the safety benefits, better traffic progression, and because roundabouts can create an "entry" point to a community by creating a more interesting intersection design. They are also typically easy to maintain in the winter because the snow plows can turn-around so easily. There are several roundabouts in Wisconsin north of Green Bay. One is in Howard and another is on Highway 22 at US-141 by Lena.

A roundabout is often used for intersections as an alternative to signalization. Roundabouts are designed with yield signs at entry points, which allow drivers to flow around the circle without stopping at a traffic light. Geometry of a roundabout is limited to speeds of 10-20 MPH within the circle. The diameter must be large enough to accommodate logging trucks and other large vehicles that commonly use the intersection. Roundabouts have been documented as safer than old traffic circles and traffic light controlled intersections because of the reduced number of conflict points from drivers making left-turns. *"The injury crashes are documented to be 35 to 78% lower than a typical signaled intersection. Overall, the average delay at a roundabout is estimated to be less than half of that at a typical signalized intersection."*[1] However, roundabouts typically require more space than a standard intersection and must have well designed approaches and exits to function properly. They are also expensive. See Figure 3-5. Two intersections on the corridor may be worthy of study for a roundabout design. These are the north and south junctions (US-141 at US-2 on the east side of Iron Mountain, and M-95 at US-2 in Breitung Township north of Iron Mountain, respectively). If a roundabout design was the desired preferred intersection alternative for either of these intersections, each such location would require a feasibility study to determine if the roundabout design could be achieved in a safe and cost-effective way that retained,

[1] Jacquemart, Georges. *"Let's Go Round and Round,"* **Planning**, June 1996.

if not improved, traffic flow (without decreasing level of service or causing additional user delay). If the analysis demonstrated feasibility and cost-effective results compared to alternative intersection designs with the same benefits, then the specifics of the roundabout design would be decided upon during the design phase. See Figure 3-5.

Figure 3-5
Roundabout Example



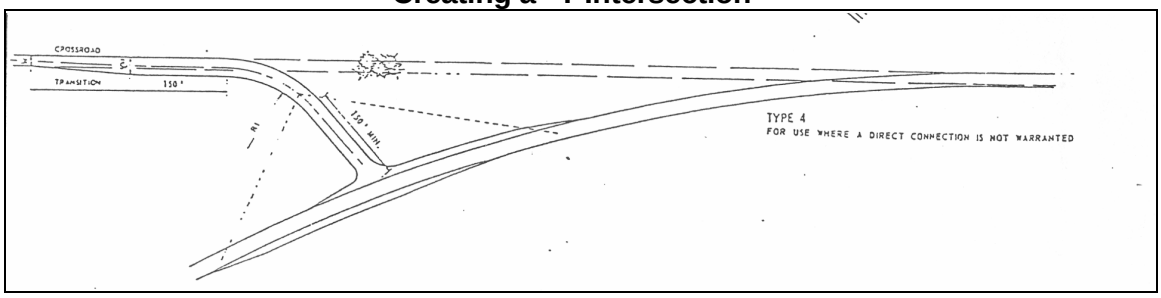
Source: Planning and Zoning Center, Inc. May 2000

Other Intersection Safety Improvements

Improve Turning Radius

Because there are many oblique intersections along US-2/US-141/M-95, and such intersections create visibility and safety issues for drivers, creating "T intersections" is a primary recommendation in Chapter Four. Creating a "T intersection" involves realigning the intersecting road so it is perpendicular to the main roadway. This allows for better, safer turning angles. See Figure 3-6.

Figure 3-6
Creating a "T Intersection"



Source: MDOT Traffic and Safety Note VII-640A "Turned-In Roadways" 2-4-91

Right-turn Lanes

Right-turning vehicles can be removed from the arterial traffic with dedicated right-turn lanes. This allows through traffic to proceed without much slowing, preserving capacity and reducing the potential for crashes. MDOT guidelines suggest the use of right-turn lanes at any intersection where a capacity analysis determines a right-turn lane is necessary to meet a desired level of service.

Access Management Improvements

This section provides a brief introduction to access management terminology which is used to describe recommendations within Chapter Four.

Close or Alter Driveways

A common problem along US-2/US-141/M-95 is properties with too many driveways. Sometimes there are three or four driveways when one well designed driveway is all that is needed. When there is not more than one driveway per parcel, and when driveways are properly spaced between properties, the roadway is safer, there are fewer crashes, and traffic flows better. As a result, one of the most effective access management techniques is driveway closure and/or redesign. An existing driveway to a parcel can not be closed unless there will still be reasonable access provided in another way, such as from a shared driveway or, an alternative access point as for example, from the rear or side of the property. Closing driveways requires careful education of property owners and should be a key part of any plan to rebuild or expand capacity on a roadway.

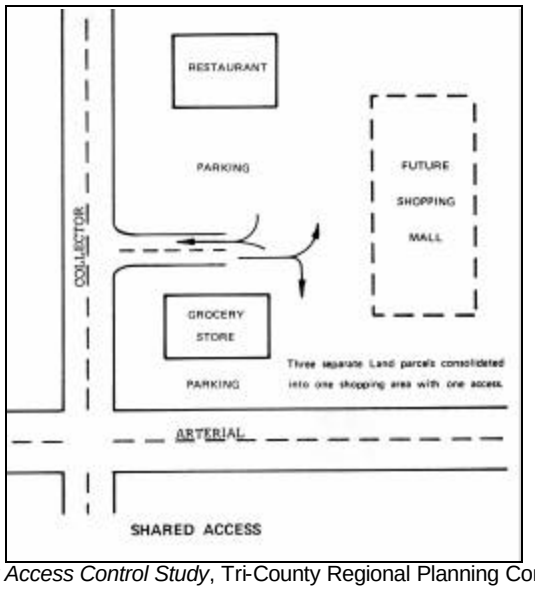
Driveway alterations can be a fairly inexpensive fix that provides a large benefit through reduction of crashes. Most commonly, driveway closures and alterations occur as part of a road reconstruction project, or when a property is proposed for redevelopment or new use. In these instances, site plan review is used as the process to ensure appropriate driveway design.

Combine or Consolidate Driveways

Close driveway spacing is a problem for two reasons: 1) for drivers turning out of adjacent driveways, competing for the same roadway; 2) for drivers that have to react to the turning movements from ingress and egress traffic at several points simultaneously. Consolidating driveways can remove a conflict point from the road and if the driveways are too closely spaced, consolidating driveways can result in the redesign of a safer driveway for both businesses. Patrons frequently go in the “wrong” driveway because of the poor design. Figure 3-7 illustrates how driveways may link together.

Two or more adjacent properties can often share driveways and limit access points to an arterial. Sharing driveways is particularly valuable when lot frontages are narrow and alternative access is not available. In newer commercial developments, shared driveways are very common. Shopping plazas often provide one or two driveways for all the stores within them. Abutting shopping plazas can also often be linked together by connecting parking lots so that drivers can avoid exiting onto main arterials when going to adjacent properties.

Figure 3-7
Shared Driveways and Connected Parking Lots



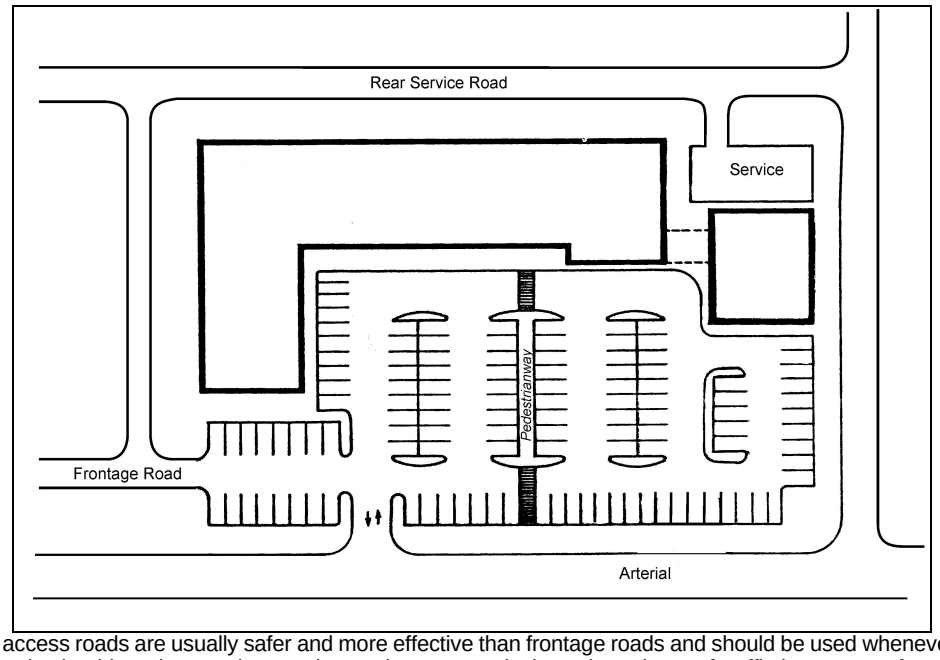
Source: *Arterial Street Access Control Study*, Tri-County Regional Planning Commission, 1981, p.24.

Frontage Roads and Rear Service Roads

Frontage roads and rear service roads can be utilized to keep traffic off of the main arterial. They can greatly reduce turning movements and direct traffic to collectors where a traffic signal can facilitate safer turns. However, frontage roads have come under some scrutiny, because they often have little stacking space near the arterial and can create confusing turning movements, if used with high traffic generation uses. Adequate space may also be unavailable for a frontage or rear service road. Frontage roads can be most effectively utilized with low traffic generators like residential and small office uses or service uses like dental and eye care. Rear service roads can usually be designed to handle larger volumes of traffic and are better for servicing commercial and industrial uses.

Frontage roads or rear access between parcels can also aid connections between properties on a smaller scale. Rear access roads should be used whenever possible to more effectively move truck traffic around a commercial site and provide alternative access connections for automobile traffic between businesses. These connections can allow traffic to circulate between adjacent commercial properties without going onto the main arterial. See Figure 3-8 which illustrates front and rear access roads.

Figure 3-8
Frontage Roads and Rear Service Roads



Note: Rear access roads are usually safer and more effective than frontage roads and should be used whenever possible. Frontage roads should not be too close to the roadway or used where the volume of traffic is too great for safe vehicle use. *Source: MDOT Michigan Access Management Guidebook, page 3-25, 2001*

Improved Local Street Connections

Secondary streets can be a very effective means of access management when they function to keep local vehicles off of the main roadway. This requires an interconnected design with streets running parallel to the main road and intersecting streets at appropriate intervals. There are very few places along the corridor where this design exists and functions well. Chapter Four includes recommendations for extending local streets, particularly in areas where commercial development could be accommodated away from the arterial.

Closing Local Streets

Sometimes a low volume local street contributes to congestion and unsafe turning movements. Where there are alternate streets nearby, closing such streets is often a useful traffic management technique. I Street in Iron Mountain will be closed in summer 2005. Washington Street should be considered for closure in the future.

Lock-In Driveways

In rural undeveloped areas, it is important to limit the number of points of access from future land divisions. This can be accomplished by a short ordinance requirement that "locks-in" not more than one access point per parcel as of the date of the ordinance. Future land divisions must take access off of the locked-in access and cannot have separate access. See description and graphic in Chapter 5.